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# A WHITE FIR VOLUME TABLE

BY

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# A WHITE FIR VOLUME TABLE

By DONALD BRUCE

White Fir (*Abies concolor*) is of increasing commercial importance. A few years ago this tree was usually left standing during logging operations, as the value of lumber to be secured therefrom was not sufficient to repay the cost of manufacture. To-day it is usually logged, and at a profit, and in the future, as timber becomes scarcer, its value will increase still more. It is therefore both natural that no accurate volume table for this species should have previously been prepared, and important that one should be made available for future use.

By means of the three-part table herein presented, the average volume in board feet of trees of given diameters and heights may be accurately determined. The table will not, however, give more than approximately the volume of an individual tree. As every woodsman knows, trees of the same diameter and height may vary widely in volume. Some trees will therefore be larger than the tabular values indicate and others smaller, but in averages of many trees these discrepancies tend to counteract each other and for large groups of trees disappear.

It is worth while to emphasize this point. Many woodsmen have noted that an ocular estimate of an individual tree may be more exact than one made by means of a volume table, and have hence thought such tables useless. It must be remembered, however, that the exact volumes of single trees are rarely of use, for what the timber owner or operator is interested in is the combined or total volume of all the trees of a given species on some specified area. Volume tables based on the averages of hundreds of accurately measured trees, will give this result as exactly as it is possible to obtain it, for they reduce to a minimum the factor of the personal judgment of the estimator. This is true, however, only where the table is properly used, and the following precautions must be observed.

The right table must be selected. It has been found impossible to prepare a single table that would be accurate for the whole state of California, since growing conditions differ widely, and differences in the form or shape of trees of similar height and diameter result. It has been established, however, that this form is essentially similar on two tracts, even if quite remote from one another, if the maximum

average height to which the trees grow at maturity is approximately the same. To determine the "site" of any given tract, then, the average height of the tallest tenth of the merchantable trees should be estimated. If this be over 9½ 16-foot logs, Table I should be used; if 7½ or under, Table III, and for intermediate values, Table II.

Heights should be measured (or estimated if the estimator has sufficient skill) in 16-foot logs, to the point in the top where the tree is 8 inches in diameter inside the bark. If, in accordance with the logging practice of any region, it is evident that this represents too close a utilization, a deduction for unused tops should be made in connection with the cull factor.

Diameters should be measured (or estimated) outside the bark at 4½ feet from the ground, measuring (in the case of sidehill timber) from the average ground level.

A deduction should be made for cull. The table is based on trees measured as if sound, unbroken, and to be completely utilized. Percentage reductions must therefore be made for

(*a*) Rot, if present.

(*b*) Breakage, if inevitable even with careful handling.

(*c*) Unused tops (see above).

(*d*) Unused stumps (if the logging practice of the region cuts stumps materially higher than 18 inches).

This cull percentage for white fir commonly ranges from 15 to 35 per cent, including all the above items; of these only the first two, however, are of much importance.

# TABLE I.

SITE I (TALLEST 10% MERCHANTABLE TREES OF STAND 9.6 LOGS OR OVER)
HEIGHT — NUMBER OF 16-FT. LOGS

| Diameter Breast-High Inches | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | VOLUME — BOARD FEET IN TENS | | | | | | | | |
| 10 | 3 | 5 | 9 | 12 | .. | .. | .. | .. | .. | .. | .. | .. |
| 12 | 4 | 7 | 11 | 15 | .. | .. | .. | .. | .. | .. | .. | .. |
| 14 | 4 | 8 | 13 | 19 | .. | .. | .. | .. | .. | .. | .. | .. |
| 16 | 4 | 10 | 16 | 23 | 30 | .. | .. | .. | .. | .. | .. | .. |
| 18 | 5 | 11 | 19 | 28 | 37 | 48 | .. | .. | .. | .. | .. | .. |
| 20 | .. | 13 | 23 | 34 | 45 | 57 | 68 | .. | .. | .. | .. | .. |
| 22 | .. | 15 | 28 | 42 | 56 | 70 | 83 | 97 | .. | .. | .. | .. |
| 24 | .. | 17 | 32 | 49 | 66 | 82 | 98 | 114 | .. | .. | .. | .. |
| 26 | .. | 19 | 38 | 58 | 78 | 97 | 117 | 136 | 156 | .. | .. | .. |
| 28 | .. | .. | 44 | 67 | 90 | 113 | 136 | 159 | 182 | .. | .. | .. |
| 30 | .. | .. | 49 | 75 | 101 | 128 | 154 | 181 | 207 | 234 | .. | .. |
| 32 | .. | .. | 56 | 85 | 114 | 144 | 174 | 204 | 233 | 263 | 292 | .. |
| 34 | .. | .. | 63 | 95 | 128 | 161 | 194 | 227 | 260 | 294 | 327 | .. |
| 36 | .. | .. | 69 | 106 | 142 | 179 | 216 | 253 | 290 | 327 | 364 | .. |
| 38 | .. | .. | .. | 117 | 157 | 198 | 238 | 279 | 320 | 360 | 401 | 441 |
| 40 | .. | .. | | 128 | 172 | 217 | 262 | 307 | 352 | 397 | 442 | 487 |
| 42 | .. | .. | .. | 139 | 188 | 237 | 286 | 335 | 384 | 432 | 481 | 528 |
| 44 | .. | .. | .. | 151 | 204 | 258 | 311 | 364 | 418 | 471 | 524 | 577 |
| 46 | .. | .. | .. | .. | 221 | 279 | 336 | 394 | 452 | 509 | 567 | 625 |
| 48 | .. | .. | .. | .. | 239 | 301 | 364 | 426 | 489 | 551 | 613 | 676 |
| 50 | .. | .. | .. | .. | 257 | 324 | 391 | 458 | 525 | 592 | 659 | 726 |
| 52 | .. | .. | .. | .. | .. | 347 | 418 | 489 | 561 | 632 | 703 | 774 |
| 54 | .. | .. | .. | .. | .. | 367 | 443 | 520 | 596 | 672 | 748 | 824 |
| 56 | .. | .. | .. | .. | .. | .. | 469 | 549 | 630 | 710 | 791 | 871 |
| 58 | .. | .. | .. | .. | .. | .. | .. | .. | 666 | 751 | 836 | 921 |
| 60 | .. | .. | .. | .. | .. | .. | .. | .. | 702 | 794 | 885 | 936 |

Stump height 1.5 feet.

Trees scaled in 16-foot logs with 0.3 foot trimming allowance, to 8 inches diameter inside bark in top, by Scribner Decimal C. rule *

Basis, 841 tree measurements taken by U. S. Forest Service, and 27 by U. S. Bureau of Plant Pathology on the Stanislaus National Forest and in the Yosemite National Park. Table prepared from taper curves by frustum form factor method. Aggregate check against basic trees shows error of -0.24%.

*This rule has been adopted as standard by the U. S. Forest Service. Its values multiplied by 10 are essentially the same as those of the Spaulding rule, which is the legal rule for California.

## TABLE II.

SITE II (TALLEST 10% MERCHANTABLE TREES OF STAND FROM 7.6 TO 9.5 LOGS.)
HEIGHT — NUMBER OF 16-FT. LOGS

| Diameter Breast-High Inches | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | VOLUME — BOARD FEET IN TENS | | | | | | | | |
| 10 | 4 | 6 | 12 | 15 | .. | .. | .. | .. | . | .. | .. | .. |
| 12 | 5 | 8 | 13 | 18 | .. | .. | .. | .. | .. | .. | .. | .. |
| 14 | 5 | 9 | 15 | 22 | .. | .. | .. | .. | .. | .. | .. | .. |
| 16 | 5 | 11 | 18 | 25 | 33 | .. | .. | .. | .. | .. | .. | .. |
| 18 | 5 | 12 | 20 | 30 | 39 | .. | .. | .. | .. | .. | .. | .. |
| 20 | .. | 13 | 23 | 35 | 46 | 58 | .. | .. | .. | .. | .. | .. |
| 22 | .. | 15 | 28 | 42 | 55 | 69 | .. | .. | .. | .. | .. | .. |
| 24 | .. | 16 | 31 | 48 | 64 | 80 | 96 | 112 | 128 | .. | .. | .. |
| 26 | .. | 18 | 36 | 55 | 75 | 93 | 112 | 130 | 148 | .. | .. | .. |
| 28 | .. | .. | 42 | 63 | 85 | 107 | 128 | 150 | 172 | .. | .. | .. |
| 30 | .. | .. | 46 | 70 | 94 | 120 | 144 | 169 | 194 | .. | .. | .. |
| 32 | .. | .. | 52 | 79 | 106 | 134 | 162 | 189 | 216 | .. | .. | .. |
| 34 | .. | .. | 58 | 88 | 118 | 148 | 179 | 209 | 239 | 269 | .. | .. |
| 36 | .. | .. | .. | .. | 131 | 165 | 197 | 234 | 266 | 298 | .. | .. |
| 38 | .. | .. | .. | .. | 144 | 181 | 218 | 256 | 293 | 330 | .. | .. |
| 40 | .. | .. | .. | .. | 158 | 199 | 240 | 281 | 323 | 365 | .. | .. |
| 42 | .. | .. | .. | .. | .. | 218 | 263 | 308 | 353 | 397 | .. | .. |
| 44 | .. | .. | .. | .. | .. | 237 | 286 | 335 | 385 | 433 | 482 | .. |
| 46 | .. | .. | .. | .. | .. | .. | 310 | 364 | 418 | 470 | 524 | .. |
| 48 | .. | .. | .. | .. | .. | .. | 338 | 396 | 454 | 512 | 569 | .. |
| 50 | .. | .. | .. | .. | .. | .. | 366 | 428 | 491 | 554 | 616 | .. |
| 52 | .. | .. | .. | .. | .. | .. | 394 | 461 | 528 | 595 | 662 | .. |
| 54 | .. | .. | .. | .. | .. | .. | .. | 493 | 566 | 638 | 710 | .. |
| 56 | .. | .. | .. | .. | .. | .. | .. | 526 | 603 | 679 | 756 | .. |
| 58 | .. | .. | .. | .. | .. | .. | .. | 561 | 644 | 726 | 808 | .. |
| 60 | .. | .. | .. | .. | .. | .. | .. | 599 | 687 | 775 | 864 | .. |

Stump height 1.5 feet.

Trees scaled in 16-foot logs with 0.3 foot trimming allowance, to 8 inches diameter inside bark in top, by Scribner Decimal C. rule.

Basis: 124 tree measurements taken by U. S. Forest Service on the Plumas and Tahoe National Forests, and 179 by the U. S. Bureau of Plant Pathology on the Sierra National Forest.

Table prepared from taper curves by frustum form factor method.

Aggregate check against basic trees shows error of -0.42%.

# TABLE III.

SITE III (TALLEST 10% OF MERCHANTABLE TREES OF STAND 7.5 LOGS OR UNDER)
HEIGHT — NUMBER OF 16-FT. LOGS

| Diameter Breast-High Inches | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | VOLUME — BOARD FEET IN TENS | | | | | | | |
| 10 | 4 | 7 | 13 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 12 | 5 | 9 | 15 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 14 | 5 | 10 | 16 | 23 | .. | .. | .. | .. | .. | .. | .. | .. |
| 16 | 5 | 11 | 18 | 26 | 34 | .. | .. | .. | .. | .. | .. | .. |
| 18 | 5 | 11 | 20 | 29 | 38 | 48 | .. | .. | .. | .. | .. | .. |
| 20 | .. | 12 | 22 | 32 | 43 | 55 | .. | .. | .. | .. | .. | .. |
| 22 | .. | 14 | 26 | 38 | 52 | 65 | .. | .. | .. | .. | .. | .. |
| 24 | .. | 15 | 28 | 44 | 60 | 74 | .. | .. | .. | .. | .. | .. |
| 26 | .. | 17 | 33 | 52 | 69 | 85 | 103 | .. | .. | .. | .. | .. |
| 28 | .. | .. | 38 | 58 | 78 | 98 | 118 | .. | .. | .. | .. | .. |
| 30 | .. | .. | 41 | 64 | 86 | 109 | 131 | 155 | 177 | .. | .. | .. |
| 32 | .. | .. | 47 | 72 | 96 | 121 | 146 | 172 | 197 | .. | .. | .. |
| 34 | .. | .. | 53 | 80 | 107 | 135 | 163 | 190 | 217 | .. | .. | .. |
| 36 | .. | .. | 57 | 89 | 118 | 148 | 179 | 211 | 241 | .. | .. | .. |
| 38 | .. | .. | .. | 97 | 129 | 165 | 197 | 232 | 266 | .. | .. | .. |
| 40 | .. | .. | .. | 105 | 142 | 179 | 217 | 254 | 291 | .. | .. | .. |
| 42 | .. | .. | .. | .. | 156 | 196 | 236 | 277 | 318 | .. | .. | .. |
| 44 | .. | .. | .. | .. | 169 | 213 | 258 | 301 | 346 | .. | .. | .. |
| 46 | .. | .. | .. | .. | 183 | 231 | 279 | 326 | 375 | .. | .. | .. |
| 48 | .. | .. | .. | .. | 199 | 250 | 302 | 354 | 406 | .. | .. | .. |
| 50 | .. | .. | .. | .. | .. | 270 | 325 | 382 | 437 | 492 | .. | .. |
| 52 | .. | .. | .. | .. | .. | 291 | 349 | 410 | 471 | 530 | .. | .. |
| 54 | .. | .. | .. | .. | .. | 310 | 374 | 438 | 502 | 567 | .. | .. |
| 56 | .. | .. | .. | .. | .. | 329 | 397 | 466 | 534 | 602 | .. | .. |
| 58 | .. | .. | .. | .. | .. | 351 | 424 | 498 | 571 | 642 | .. | .. |
| 60 | .. | .. | .. | .. | .. | 372 | 448 | 526 | 604 | 683 | .. | .. |

Stump height 1.5 feet.

Trees scaled in 16-ft. logs with 0.3 foot trimming allowance, to 8 inches diameter inside bark in top, by Scribner Decimal C. rule.

Basis: 206 tree measurements taken by U. S. Bureau of Plant Pathology in the Tahoe and Siskiyou regions.

Table prepared from taper curves by frustum form factor method.

Aggregate check against basic trees shows error of -0.17%.